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RESEARCH UNIT FOR URBAN STUDIES
McMASTER UNIVERSITY
HAMILTON, ONTARIO

REGIONAL MUNICIPALITY

OF

HAMILTON - WENTWORTH

PLANNING AND DEVELOPMENT DEPARTMENT

SETTLEMENT CAPABILITY STUDY

FOR

THE FREELTON AREA

Underwood McLellan Ltd.

the uma group

Underwood McLellan Ltd.

89 Carlingview Drive
Rexdale (Toronto), Ontario M9W 5E4
Telephone (416) 675-6484

July 16, 1980 File #1931-019

Mr. Joachim L. Schwarz, M.C.I.P.
Senior Planner
Regional Planning Division
Regional Municipality of Hamilton-Wentworth
100 Main Street East
Hamilton, Ontario
L8N 1G8

Dear Mr. Schwarz,

Re: Freelton

We are pleased to submit 50 copies of the final report and plan completed in accordance with the project's terms of reference.

It has been concluded that considerable potential exists for continuing community development, based on the provision of a communal water supply and the use of individual private septic tank and tile field systems for sewage disposal.

We trust you will find this submission to be satisfactory.

Yours very truly,

UNDERWOOD McLELLAN LTD.

Karl Reichert, P. Eng.,
Director, Environmental Engineering &
Assistant Branch Manager

KR:sd
Encl.

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REGION OF HAMILTON-WENTWORTH

PLANNING AND DEVELOPMENT DEPARTMENT

OFFICIAL PLAN DIVISION

"SETTLEMENT CAPABILITY STUDY"

FOR THE

FREELTON AREA

UNDERWOOD McLELLAN LTD.

July 1980

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1.0 INTRODUCTION

The Regional Municipality of Hamilton-Wentworth has identified the need for additional rural development. In 1975 and 1976, twenty-eight settlement areas in the Region were evaluated to determine general terrain conditions, means of water supply and methods of sewage disposal. That preliminary study, completed by Underwood McLellan Ltd., established a potential development population for each settlement based on the provision of available water and the suitability of the soils for private on-site sewage disposal facilities.

In 1979, the Region indicated that two of the original twenty-eight study areas, Freelton and Woodburn, were to be the subjects of a more detailed assessment to determine if more residential development could be permitted and where it should be allowed in each of these communities. The following report examines the development capability of Freelton. The terms of reference for this study are included in Appendix A.

2.0 Purpose

The purpose of the study is to determine the ultimate size of development which could safely be supported in Freelton on the basis of individual private wells and septic tanks and tile field disposal systems. Communal wells and other economically and environmentally acceptable sewage disposal systems, or a combination of these are an alternative consideration for supporting any future development.

3.0 Location

The study area surrounding the community of Freelton is located in the Township of Flamborough (formerly the Townships of East and West Flamborough) in the Region of Hamilton-Wentworth. Located 18 miles south of the City of Guelph and 10 miles north of the Town of Dundas on Highway 6, the community is centered along Regional Road 51, Guelph Street. The study area comprises Parts of Lots 6-8 Concession 8, Lots 5-8 Concession 9, (formerly the Township of West Flamborough) and Parts of Lots 12 and 13 Concession 10 and Lot 12 Concession 11, (formerly the Township of East Flamborough).

The study area limits were established by utilizing the natural boundaries of the watercourses east and west of the community with the associated low lying lands. The north and south limits were selected to extend significantly beyond the existing developed areas.

4.0 FIELD PROGRAM

Once the boundaries of the study area had been established, the lands were analyzed by air photo interpretation in conjunction with soils and agricultural base maps to establish the various land units represented in and around the community of Freelton. Test holes were located and drilled to determine the soil and groundwater characteristics of the lands under investigation. Their locations are shown on Figure 1. Additional published geotechnical reports by the Trow Group Ltd. and Morrison and Beatty Ltd. provided further documentation of the study area.

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4.0 Field Program (con't)

An introductory letter from the Region of Hamilton-Wentworth explaining the study was mailed to each of the land owners on February 15, 1980, where a test hole was proposed to be located. Copies of this letter and the returned permission forms are contained in Appendix B. A questionnaire was prepared to obtain information on the water supply and waste disposal systems currently in use by representative property owners. Where no residence was situated on the property, neighbours were contacted. Door to door interviews were carried out commencing March 16, 1980 and were completed April 7, 1980. Interviews were conducted during the day hours and many have been followed up by telephone discussions. The persons were aware of the project and were quite receptive to providing as much information as possible. Although none of the original driller's logs were available, the residents were generally able to complete the rest of the questionnaire without problems. A summary of the questionnaire findings are contained in Table 1 of this report.

Water samples were taken from three of the households during the water supply and sewage disposal survey. This limited amount of sampling was conducted to obtain only an approximation of the range in water quality. More extensive sampling was not considered to be necessary. All the water samples were obtained from the well via the kitchen tap. The findings of the Region's laboratory regarding its bacterialogical examination and chemical analyses of the water samples are given in Table 2.

TABLE 1

SUMMARY OF FREELTON

WATER SUPPLY AND WASTE DISPOSAL SURVEY

SECTION	PERSONS CONTACTED AND PROPERTY LOCATION IN TOWNSHIP OF FLAMBOROUGH				
A) Water Supply	W.T. Elliot	G. Mathies	Wm.R. Weir	N.W. Nicholson	A. Coverdale
	Conc. 9 Lot 5	Conc. 9 Lot 6	Conc. 11 Lot 12	Wildan Dev. Ltd. Conc. 10 Lot 13	Conc. 10 Lot 13
Date of Survey	March 16, 1980	March 21, 1980	March 26, 1980	April 7, 1980	April 7, 1980
Drillers Log	---	---	---	---	---
Type of Well	Drilled	Drilled	Drilled	Drilled	Drilled
Depth of Well	62' (18.91 m)	40' (12.2 m)	63' (19.22 m)	69' (21.05 m)	35' (10.68 m)
Depth of Casing	62' (18.91 m)	38' (11.59 m)	30' (9.15 m)	14' (4.27 m)	35' (10.68 m)
Location of Screen (if any)	No	No	No	No	No
Diameter of Well	6" (.153 m)	6" (.153 m)	6" (.153 m)	10" (3.05 m)	6" (.153 m)
Aquifer Type and Depth	Limestone 0030 (9.15 m)	Gravel	Limestone 0030 (9.15 m)	Limestone 0005(1)(1.525 m)	Limestone
Static Water Level	---	14" (4.27 m)	23'-25' (7.02-7.63 m)	19'2" (5.85 m)	12'-13' (3.66-3.96 m)
Pumping Water Level	---	20' (6.1 m)	No change	23 1/2'(7.17 m)	Up to 1' change
Pumping Rate	6 GPM (27.27 LPM)	+4 GPM (18.18 LPM)	5 GPM (22.73 LPM)	100 GPM (454.6 LPM)	10 GPM (45.46 LPM)
Quality of Water	Good	Good	Good	Good	Hard (1)

TABLE 1 (con't)

SECTION	PERSONS CONTACTED AND PROPERTY LOCATION IN TOWNSHIP OF FLAMBOROUGH				
Other Comments	1. Well is sealed	Owner has old 90' (27.45 m) deep community well on another property Static W. Lvl. is 32' (9.67 m) can be pumped dry with heavy use		1. 4'-5' (1.22-1.525 m) of overburden then rock. Communal well servicing 53 of 88 total homes in Wildan Development	1. Softner necessary
B) Waste Disposal	W.T. Elliot	G. Mathies	Wm. R. Weir	N.W. Nicholson	A. Coverdale
Type of Waste Disposal	Below grade field	Below grade field	2 below grade fields	Each household on individual below grade tile field	Below grade field (hauled in 4' of fill)
No. of House Occupants	3	Summer help (max. 10) at vegetable stand	a) 2 in 1 house b) 1 in 2nd house		5
Frequency of Maintenance	1 pump out in 6 years	Never	a) 1 or 2 pump outs in 15 years b) Never		Never in 4 1/2 years
Problems	None	None	None		None

TABLE 2

SUMMARY OF BACTERIALOGICAL EXAMINATION

AND CHEMICAL ANALYSIS OF WATER SAMPLES

FREELTON STUDY AREA

	HOUSEHOLD SURVEYED		
Parameter	W.T. Elliot Conc. 9 Lot 5	G. Mathies Conc. 9 Lot 6	Wildan Developments Ltd. Conc. 10 Lot 13
Total Coliform/100 ml.	2	360	0
Fecal Coliform/100 ml.	0	0	0
Ammonia (ppm)	0.02	0.02	0.01
Nitrates (ppm)	1.5	9.2	2.2
Sulphates (ppm)	93	62	44
Iron (ppm)	13	<.05	<.05
pH	7.6	7.5	7.5
Chloride (ppm)	17	4	24
Total Hardness (ppm)	376	340	340
Alkalinity (ppm)	276	290	300
Total Dissolved Solids (ppm)	421	414	398
Sulphur (ppm)	ND	ND	ND

NOTE: ND = Not Detected

4.0 FIELD PROGRAM (con't)

The Trow Group Ltd. of Hamilton, a soils consulting and testing firm, was retained to drill four test holes. The borings were advanced using continuous flight auger equipment to bedrock or 20 feet (6.1 metre) whichever occurred first. Representative samples were recovered at regular intervals for the purpose of subsoil identification. Soil types for each test hole were logged as were the water table locations if encountered. In addition, standpipes were installed in each hole to enable measurement of a "stabilized" water level at a later date.

A 4-foot (1.2 metre) percolation test hole was put down adjacent to each soil test hole. Percolation tests were conducted a few days later on March 28 and 30, 1980. The positioning of the test holes was generally intended to reflect the character of the different area soils for tile field installations. The corresponding test hole records and percolation tests are contained in the Trow Group Ltd. report in Appendix C.

In addition to the four soil test holes drilled for this project, additional background data included results for six test holes associated with the Trow Group Ltd. investigation of the Separate School site in Freelton, 10 pits described in a 1979 Morrison Beatty Ltd. report and the over 70 Ministry of the Environment records for wells distributed throughout the study area. In only five cases of the total 90 samples was the bedrock located within 10 feet (3.05 m) of the ground surface. These locations are identified in Figure 1. As it is not possible, based on the current level of information to locate the total extent of these isolated bedrock situations, only a detailed drilling program will confirm whether bedrock does occur 10 feet (3.05) below a specific development area. All data appears, however, to indicate the bedrock is generlly found at depths greater than 10 feet (3.05 m) throughout the study area.

5.0 GENERAL DISCUSSION

5.1 Bedrock

From existing information, the bedrock within the Freelton Study Area is a Silurian dolomitic limestone. The depth to the bedrock from the ground surface appears to generally be greater than 20 to 25 feet (6.1 to 7.6 metre) with some occurrences when it is 10 feet (3.05 metre) or less. Because the bedrock surface is uneven, it can be expected that the depth of overburden will vary.

5.2 Soils

The soil type overlying the bedrock is, for the most part, a sandy silty till with some coarser granular layers interspersed throughout. The till is very often overlain at surface with a veneer of sandy silt to silty sand. In addition, east-west trending granular outwash features are associated with the till. The interpreted extent of the till (Unit 6) the granular outwash (Units 4A & 4B) and organic soils (Unit 1) are shown on Figure 1.

5.3 Topography

The topography of the Freelton Study Area is gently rolling. Slopes are predominantly less than 10% with isolated areas of 10% to 20% slopes as illustrated on Figure 1.

5.4 Surficial Drainage

The gently rolling topography and good internal soil drainage provides for good overall surficial drainage. Only at the headwater tributary of Bronte Creek at the south edge of the community is the groundwater table at ground surface, where it discharges to the creek. The surface drainage features are shown on Figure 1.

5.5 Groundwater

The groundwater table is at surface only at the headwater tributary of Bronte Creek as mentioned above. During the test drilling program for this study, water table levels in the overburden soils ranged from 2 feet to 8 feet (.61 to 2.4 metres) below ground surface in the four test holes. None of the test holes penetrated the bedrock and therefore, it is expected that this water table represents a perched table in the overburden and that it would have seasonable variations. This perched table was likely close to its highest level due to snow melt and spring rain contributions.

The majority of water wells in the area are founded in and obtain water from the fractured limestone bedrock at depths ranging generally from 25 to 75 feet (7.6 to 22.9 metre) below ground surface. Water is not found consistently at the limestone bedrock surface and often the bedrock has to be penetrated up to 50 feet (15.2 metre) before water is encountered. The static water level in the bedrock aquifer does not always rise to above the bedrock surface. Most often it rises to within 10 feet (3.05 metres) of the bedrock surface.

Existing water well data Appendix D, indicates that the aquifer yield potential varies considerably and is dependent upon the degree of fracturing in the limestone. The specific capacities indicated in water well records varied from a fraction of a gallon to flows in the order of 5 gpm/ft. of drawdown. Only occasionally did specific capacities approach 10 gpm/ft. The available information suggests that there would be a fair probability of constructing individual bedrock wells with yields of 25 to 50 gpm (113.7 - 227.3 lpm) and occasionally 100 gpm (454.6 lpm). The probability is good for the construction of wells with yields of 1-5 gpm (4.5 - 22.7 lpm) from the bedrock. The existing well that serves the Wildan subdivision has a rated pumping capacity of 100 gpm (454.6 lpm). The water quality is generally good. The available information indicates that reliable wells generally could not be constructed in the overburden.

5.5 Groundwater (con't)

Based on the foregoing analysis, it has been projected that an additional well(s) water supply could be obtained within Freelton that would have a capacity of 100 gpm. The data does not support a reasonable probability in support of more than 200 gpm being available from wells constructed in Freelton. Accordingly, a communal water system could be developed to serve Freelton within this service capacity. Confirmation of the ground water potential should follow the completion of a test drilling program.

The total coliform content in one of the wells was quite high, although, no fecal coliform were present. This well should be disinfected with a small amount of "Javex" or similar chlorine solution and retested. It is expected that this procedure will clear the present water quality problem. The other wells were satisfactory and we are not aware of a well contamination problem existing in Freelton.

The ammonia, nitrate, sulphate, chloride, hardness, alkalinity, total dissolved solids and hydrogen sulphide concentrations were all within accepted limits in the tested well waters. There were no reported instances of hydrogen sulphide being present in the well waters in Freelton.

Although all nitrate concentrations were below the Provincial recommended maximum of 10.0 ppm, one of the water samples had a concentration of 9.2 ppm. Waters containing nitrate concentrations in excess of 10.0 ppm are not known to be common in this area. When this upper limit is exceeded, the water is still safe for human consumption except that it should not be used in infant feeding. The disease methemoglobinemia can cause death of infants less than three months old when fed water with a high nitrate concentration. A similar effect has not been reported in older children or adults.

One well water sample had an iron concentration of 1.3 ppm which greatly exceeds the recommended Provincial maximum of 0.3 ppm. This water will cause staining and will be aesthetically objectionable. Otherwise no adverse effects occur in the use of this water for domestic uses.

Generally, the ground water quality in the Freelton area is quite acceptable for domestic use.

5.6 Alternative Methods of Sewage Disposal

Alternative methods of sewage disposal have been considered, as discussed in Appendix E.

While alternative systems could be considered, Class 4 (septic tank and tile field systems) are considered to be the most appropriate. The system, if constructed properly, and if maintained through regular pump-outs of the tank offers the most economical from of sewage disposal for the Freelton residents and requires a minimum of maintenance attention.

6.0 CONCLUSIONS

Groundwater occurs within the limestone bedrock and in the silty sandy overburden soils as a perched water table. The perched water table condition varies seasonably depending upon precipitation and spring snowmelt. Where the surface of the bedrock is fractured there is likely direct recharge from the perched water table to the underlying limestone bedrock aquifer, particularly when the perched water table is high. It is suspected, however, that the majority of the groundwater discharge from the overburden soils is horizontal and is to the adjacent surface drainages that are tributary to Bronte Creek. Heavy pumping of the bedrock aquifer, particularly in areas where the surface of bedrock is fractured, would tend to induce recharge from the overburden soils to the bedrock aquifer. Surficial drainage is to the tributaries of Bronte Creek.

The results of the testing program and the above observations lead to the following conclusions for the future development of the Freelton Study Area.

1. The silty sandy overburden soils are suitable for the construction of individual septic tank and tile field sewage disposal systems and have a permeability of approximately 10^{-5} cm/sec. The recommended field and lot sizes based on the soil permeability and an input of 300 gpd (1360 Lpd) is:

Lineal Feet of Tile in Single Field	880 ft. (268.4 m)
Area for Single Field including 10-foot Buffer	4,800 sq.ft. (446.2 sq.m)

6.0 CONCLUSIONS (con't)

Recommended Area including Stand-by	14,000 sq.ft. (1301 sq.m)
Implied Minimum Lot Size	100 ft. x 235 ft. (30.5 m x 71.6 m)
Implied Lot Area	0.539 acres (0.218 ha.)

2. Wells should not be developed in the overburden soils which have a low yield because of the potential for contamination from the septic fields. The deeper bedrock wells should be located away from the proposed future developent areas and existing development in order to limit induced recharge directly from the overburden to the bedrock aquifer.

3. The following areas could accommodate additional residential development to the degree indicated. These areas area shown on Figure 2 and are summarized in Table 3.

I. Northwest Area

This area is bounded by the existing community, Highway #97 and the north and west limits of the study area. The steeply sloping lands are generally not suitable for development. Otherwise the remaining lands are considered to be suitable for single family development. The land area is approximately 100 acres and it is possible that approximately 140 single family residences could be located here.

6.0 CONCLUSIONS (con't)

II. Southwest Area

This area is bounded by Highway #97, Highway #6 and the southerly limit of the study area. The lands located in the southerly portion of this area adjacent to Highway #6 are low lying and are not suitable for development unless large amounts of suitable fill are imported. The remaining area of 118 acres could accommodate approximately 160 single family residences.

III. Southeast Area

Area III is located south of the 11th Concession Road and east of Highway #6 to the study area limits. A large portion of the lands are now developed and the lands which are low lying and border onto Bronte Creek are generally too low to be considered for development due to high watertable conditions. The three parcels of land surrounding the existing Wildan subdivision between the 10th and 11th Concession Roads contain 67 acres of land. These are considered as being suitable for continued development and could support approximately 90 homes.

IV. Northeast Area

This area is bounded by Highway #6 and the 11th Concession Road and extends north to the study area limits. Except for a small area north of the intersection of the referenced two roads, which is topographically high, the remainder of the area has a high watertable and therefore, would not be suitable for community development. Further, the remaining area is low and is not recommended for development. Accordingly, this area should not be extensively developed.

6.0 CONCLUSIONS (con't)

V. Central Area

This area which includes the existing development in Freelton, fronts onto Guelph Street and extends east to Highway #6, could be infilled to a limited extent only. Development should not be permitted in the low lying, high water table area. Approximately 30 single family residences could be located on the vacant topographically high lands in this area.

In addition, the existing Wildan subdivision which fronts onto Highway #6 has been included in the Central Area. Phase I which developed 53 homes has been included in the existing Freelton population. The second phase of the plan provides for 25 more homes to be constructed. These additional 25 homes could accommodate approximately 83 persons.

TABLE 3
SUMMARY OF DEVELOPMENT POTENTIAL
FOR VACANT LANDS IN FREELTON

Development Area No.	Area Acres	Area Hectares		Possible No. of New Dwelling Units	Potential Population
I	100	40.47		140	462
II	118	47.75		160	528
III	67	27.11		90	297
IV			NO DEVELOPMENT PROPOSED		
V	41.8	16.93		55	182
TOTAL	326.8	132.26		445	1,451

6.0 CONCLUSIONS (con't)

4. The headwater tributaries of Bronte Creek are considered to be a valuable fisheries resource. Care must be taken to set development back sufficiently from these tributaries to avoid contamination due to seepage from septic disposal fields. It is considered that the areas proposed for future development satisfy this criteria.

5. While specific development potentials have been determined based on residential development being allowed to locate on suitable lands in Freelton, it is also possible to accommodate institutional industrial or commercial development within the study area based on the provision of a Regionally owned communal water supply and the use of individual septic tank and tile field systems for sewage disposal.

   Only domestic sewage should be discharged to this type of system. A septic tank and tile field system equivalent to a single family residence would generally be adequate for 12 employees. Other establishments that would not meet this criteria should be required to locate where sanitary sewers could be provided. In particular, "wet" industry, laundramats and restaurants would be included in this latter category.

6. Within the study area it is expected that a ground water supply of 100 gpm (454.6 lpm) could be developed in addition to the existing 100 gpm (454.6 lpm) Wildan subdivision well. This water supply would be adequate to serve a total population of 1,300 to 1,500 people. The existing population is now about 600 people. It has been assumed that either at grade or elevated storage would be constructed to provide the peak hour or fire protection demands.

7. Water quality in the existing wells within Freelton is acceptable for domestic use and it is expected that a similar water quality would be obtained in new wells.

7.0 RECOMMENDATIONS

1. A Regionally owned communal water system should be constructed to serve all existing and future development in Freelton.

2. Individual private septic tank and tile field systems should be utilized for sewage disposal.

3. The minimum recommended residential lot area is 0.539 acres (0.218 ha.). Larger areas would be required where some of the lands are not considered to be in a buildable category. Each lot should have an area of at least 14,000 sq.ft. (1,301 sq.m) that is suitable for the construction of the tile field.

4. Only domestic wastes from commercial or industrial development should be permitted to utilize septic tank and tile field systems for sewage disposal. Proposed establishments where other wastes would be discharged should not be permitted to locate in Freelton.

5. The maximum development level in Freelton should be 1,300 to 1,500 people, based on the projected ground water supply capability and land suitable for the installation of septic tank and tile field systems.

6. All development proposals should be submitted with adequate on-site testing to confirm the overburden depths throughout the development area are adequate for the installation of tile field systems.

7.0 RECOMMENDATIONS (con't)

7. The adoption of the recommended upper limit to development in Freelton (No.5) should follow the completion of test drilling to confirm the adequacy of the ground water aquifer.

Respectfully Sumbitted,

Karl Reichert, P. Eng.,
Director, Environmental Engineering &
Assistant Branch Manger

Michael Brown, B.E.S.,
Planner

APPENDIX A

STUDY TERMS OF REFERENCE

THE REGIONAL MUNICIPALITY OF
HAMILTON
WENTWORTH

December 14,1979 File # R.555.3

Mr. Karl Reichart, P.Eng.,
Director
Environmental Engineering and
Assistant Branch Manager
89 Carlingview Drive
Rexdale, Ontario
M9W 5E4

Dear Karl:

SUBJECT: Settlement Capability Studies
for Woodburn and Freelton

This letter is to advise that on December 4,1979, Regional Council approved the recommendation to retain your firm to carry out the above noted studies.

You are hereby requested to commence the study and submit the details of the field work which require co-ordination with the local Municipal Councils and/or residents.

The Officials in the Area Municipalities of Glanbrook and Flamborough have been advised of the proposed studies and we will arrange the necessary meetings after receiving the details of the work program from your office.

Our solicitor will prepare the necessary agreement which will be forwarded to you in the near future.

Yours truly,

Mohammed Afsar, P.Eng.,
Senior Planner
Regional Planning Division.

MA;hk

Planning and Development Department.
100 Main St., East, Hamilton, Ont. L8N 1G8

November 20, 1979

Mr. M. Afsar, P. Eng.,
Senior Planner
Regional Planning Division
Regional Municipality of Hamilton-Wentworth
Planning and Development Department
100 Main Street East
Hamilton, Ontario
L8N 1G8

Dear Mr. Afsar,

Re: Settlement Capability Study for:
Woodburn - Township of Glanbrook
Freelton - Township of Flamborough

Further to our letters of October 26, 1979, and our discussions on November 12 and 15, 1979, we have reviewed the scope of work and costs to carry out assessements of Woodburn and Freelton for further settlement development.

The revised proposal follows:

Scope of Work

1. Obtain recent additional information on new water wells from the MOE, analyze this data together with the data now in our files to determine the probable safe groundwater yield in the Woodburn and Freelton areas. Prepare a tabulation of all this data.

2. Obtain recent additional information on development proposals and new septic tank systems from the Health Department.

3. Review other relevant background information that may be available from the Conservation Authority, the Agricultural representative relating to land drainage, flooding, etc., within the study area. Prepare a summary of all background data.

4. Conduct a door to door survey of a number of homes, to obtain information on present water table elevations, water supply reliability, water samples for bacterialogical examination and chemical analysis. It is anticipated that the samples would be analyzed by the Region's laboratory. Also obtain information on sewage disposal systems.

5. Utilizing well log information and available topographical plans of the area beyond the study area, determine the direction of groundwater flow and, if possible, the groundwater recharge area. It is important that the recharge areas close to the settlement be identified and protected from development that could affect the groundwater quality.

6. Retain a soils consulting and testing firm to construct a number of deep test holes to bedrock or 20 ft. which ever is greater. It is anticipated that approximately 12 holes would be put down in Woodburn and 6 holes in Freelton. Soil types for each test hole would be logged and also the water table location, if encountered. Due to expected soil type variability it will be necessary to enter on to private lands in Woodburn in order to place the test holes at representative locations. We would mark the test location on a plan and request that a Region of Hamilton-Wentworth representative contact the affected property owners to seek and obtain permission to enter on to the private property for soil testing. The resolution of access to the lands could be somewhat time consuming and impossible to judge when it could be completed. Accordingly, this proposal does not include the time associated with the securing of permission to enter on to the private lands.

7. Determine the susceptibility of ground and surface water to contamination from development located on the higher lands and along the existing watercourses. Assess the alternatives to protect these waters while permitting the development of the settlements. This aspect is particularly important in areas that may have a relatively shallow depth of overburden over the groundwater table or bedrock.

8. Determine the tile field requirements for different types of development, located in the different soils of the study area.

9. Determine the extent of development possible based on the use of individual groundwater or communal (Regionally owned) water supplies and on the identified aquifer potential.

10. Determine the minimum residential lot area that should be provided in the different near surface soil types, and provide recommendations on development density for residential development, and guidelines for commercial and industrial development, based on the sewage disposal system requirements.

11. Determine the ultimate development capability possible in the study area based on the use of individual private well water supplies and on communal or Regionally owned water systems. Prepare recommendations on the approach that should be followed during the construction of new housing to protect the tile field area from damage due to construction traffic.

12. Outline a monitoring program to determine when the development of an area is approaching its ultimate development capability.

13. Preparation of a report and plan for each settlement, review with the Client, amend and finalize, provide the Client with 50 copies of the report.

APPENDIX B

INTRODUCTORY LETTER FROM REGION OF HAMILTON-WENTWORTH
SIGNED PERMISSION FORMS

THE REGIONAL MUNICIPALITY OF
HAMILTON WENTWORTH

February 15,1980

File # R 555.3

Dear Property Owner:

On December 4,1979, Regional Council approved a study of the development capability of the Freelton Settlement Area. The purpose of the study is to determine if any more residential development can be permitted in Woodburn and where it should be permitted.

The Region has retained Underwood McLellan (1977) Ltd., as a Consultant to conduct this study. As part of the research the Consultant must ascertain soil and ground water characteristics of the lands under investigation by drilling tests on various properties. This procedure will be undertaken at no cost to you.

By this letter we wish to request your permission to permit our Consultant to enter your property to undertake the required tests. We trust that you will grant this permission so that the study may proceed.

The Consultant has scheduled testing for the last two weeks of March 1980. Upon receipt of the attached permission form you will be notified of the precise date when tests will be performed on your property. These tests should not result in any damage to your property. However, if there is any cause for claims the Consultant is fully responsible.

We attach a prepaid envelope and permission form. Please sign the form and return to our office.

We wish to thank you in advance for your co-operation. Should you wish to have additional information please do not hesitate to contact myself or Mr. J.L. Schwarz of my department. (Tel. 526-4178).

Yours very truly,

D.A. Lychak, M.C.I.P.
Commissioner
Planning and Development

JSB; hk

Planning and Development Department.
100 Main St. East, Hamilton, Ont. L8N 1G8

RECEIVED FEB 29 1980

PERMISSION

I hereby give the Consultant, Underwood McLellan (1977) Ltd. permission to enter my property for the purpose of test drilling. It is my understanding that the tests will not result in any damage to my property, and in the event that any damage be caused, the Consultant will assume responsibility.

DATED this 25 day of February - 1980.

Above permission granted with the (2) Considerations marked below.

Mr D.A. Lychak

(1) Test Drilling personnel must check in at the House before entering property

(2) I must receive a copy of the test drillers & Underwood McLellan (1977) LTD. report of this property

RECEIVED FEB 22 1980

PERMISSION

I hereby give the Consultant, Underwood McLellan (1977) Ltd. permission to enter my property for the purpose of test drilling. It is my understanding that the tests will not result in any damage to my property, and in the event that any damage be caused, the Consultant will assume responsibility.

DATED this 19 day of Feb. 1980.

D J Mathies

Please be advised that approximately 3 wks. ago Mr. Morrison of Morrison and Beatty Ltd. were given permission to release copies of test reports recently take of Centinial Heights for Glansby and Manrow Professional Engineers.
Mr Karl Reichart of Underwood McLellan was to receive these copies with the understanding any cost of reproduction etc. being at their expense.
Trusting this will be of help

Sincerely
D J Mathies

dk+2

P E R M I S S I O N

I hereby give the Consultant, Underwood McLellan (1977) Limited, permission to enter my property for the purpose of test drilling. It is my understanding that the tests will not result in any damage to my property, and in the event that any damage be caused, the Consultant will assume responsibility.

DATED this 20th day of February, 1980.

C. K. Youngs, P.Eng.
Vice President
Planistics Engineering Ltd.
Agent for Wildan Developments Ltd.

lit & 45

RECEIVED FEB 2 8 1980

PERMISSION

I hereby give the Consultant, Underwood McLellan (1977) Ltd. permission to enter my property for the purpose of test drilling. It is my understanding that the tests will not result in any damage to my property, and in the event that any damage be caused, the Consultant will assume responsibility.

DATED this 21 day of February 1980.

Wm. Roy Weir

URBAN DOCUMENTATION CENTRE
RESEARCH UNIT FOR URBAN STUDIES
McMASTER UNIVERSITY
HAMILTON, ONTARIO

5 of 6

APPENDIX C

THE TROW GROUP LIMITED REPORT
PRELIMINARY GEOTECHNICAL INVESTIGATION
AND
SEPTIC SUITABILITY STUDY
FREELTON, ONTARIO

CONSULTING
ENGINEERS

The Trow Group Limited

HAMILTON BRANCH
P.O. BOX 430, STN. B, HAMILTON, ONTARIO, L8L 7W2
TELEPHONE (416) 560-3001

Project: H3291-G

March 31, 1980

Underwood McLellan Ltd.
c/o UMA Group
89 Carlingview Drive
Rexdale, Ontario
M9W 5E4

Attention: Mr. C. Anderson

Preliminary Geotechnical Investigation
and Septic Suitability Study
Freelton, Ontario

Dear Sirs,

The Trow Group Limited was retained to conduct a preliminary geotechnical investigation at the above noted site. The objective of this investigation was to present a general overview of the subsoil and ground water conditions prevailing at the site and comment on the general suitability of these subsoils for sewage disposal using septic tile methods.

Four (4) exploratory borings were put down at locations selected by a representative of Underwood McLellan Ltd. These borings were advanced to a maximum depth of 6.1 m (20 feet) on March 26, 1980 by Longyear Canada Incorporated using continuous flight auger equipment. Representative samples were recovered at regular intervals for the purpose of subsoil identification and to subsequent laboratory testing, if required, at a later date. In addition, a percolation test hole was put down adjacent to each boring as per the enclosed Drawing 7.

Observations of the ground water were conducted in the open borings during the course of the fieldwork. In addition, standpipes were installed in each boring to enable measurement of a "stabilized" water level at a later date.

The borehole locations have been established by The UMA Group and are on file with them.

SUBSOIL CONDITIONS

A review of published pedological studies for this area indicates that the subsoils in this area consist primarily of sandy loams and tills associated with moraines and drumlins common to this area. Soils of the Dumfries and Guelph series comprise these glacial features while a deposit of gently rolling sandy loam over outwash gravel (Burford series) borders the creek which courses across the southwest area of concern.

The borings put down at the site confirm this information. Deposits of sandy silt to silty sand with seams of gravel and cobbles were confirmed in all the borings. Due to the extend of area covered by this investigation, it is not possible to correlate the borings. Examination of the recovered samples, however, indicates that, although silty sand to sandy silt was proven in all of the borings, it is not likely to represent a single deposit but rather two or more. For example, Borehole 1, opposite Beachgrove School, is representative of the Dumfries Series soil, while the soil encountered in Borehole 4 is typical of that associated with the Burford series. Each subsoil has different characteristics with regard to permeability (drainage), texture, colour, etc. Details of the subsoil are given on the Borehole Logs, Drawings 1 to 4.

The bedrock was noted to be fairly shallow at this site, with refusal to augers noted at 4.7 m (15.5 feet) and 3.4 m (11.2 feet)in Boreholes 2 and 4, respectively.

The ground water levels were recorded several days after standpipe installation and areshown on the attached borehole logs and percolation test plots.

SEPTIC TILE SUITABILITY

Percolation tests were carried out between March 28 and 30, 1980 following the method specified by the Ontario Ministry of the Environment. In addition, all the test holes were well saturated beyond the minimum recommended by the MOE as it rained at the site over the several days prior to testing. In addition, water was added to each test hole on a practically continuous bases for at least 44 hours before the tests were performed.

The results of the percolation tests are presented on Drawings 6 and 7. Drawing 6 contains the results for Test Holes 1 to 4, inclusive as specified by UMA, whereas Drawing 7 presents the results obtained in six more closely spaced percolation tests performed on the Separate School Property just west of Highway 6 and north of Highway 97.* The percolation rates can be computed from these plots.

With reference to Drawing 6, it is noted that the rate of water fall in Test Hole #1 was very slow. This may possibly be the result of founding the test hole within a localized deposit of silt within the drumlin. Alternatively, and more likely, the slow rate of fall can be attributed to the proximity of the ground water table, i.e., while the adjacent standpipe indicated a water table at approximately 58 inches depth, the ground surface at the standpipe was significantly higher than the test hole location. In addition approximately 16 inches of water was present in the test hole prior to commencement of saturation, and likely reflects a "stabilized" water level. The water level at Test Hole 2 appears to have stabilized near the level of the ground water table recorded in the adjacent standpipe.

Drawing 7 illustrates the large variation in percolation rates even within relatively closely spaced test hole.

* See Drawing 8. A typical Borehole Log from this site is also included, Drawing 5.

We trust that this brief report meets with your satisfactory and that you will contact this office should you require further assistance.

Yours very truly,
THE TROW GROUP LIMITED

M. H. MacKay, P.Eng.

D.Schebesch, P. Eng.

MHM/ml
Encl.
Dist: Underwood McLellan Ltd.
c/o UMA Group (2)

BOREHOLE LOG

JOB No. H3291-G | BOREHOLE No. 1 | DRAWING No. 1

PROJECT Proposed Development
LOCATION Opposite Beachgrove School
Freelton, Ontario

HOLE LOCATION AND DATUM SEE DRAWING NO. 1

AUGER SAMPLE
SPT (N) VALUE
DYNAMIC CONE TEST
SHELBY TUBE
FIELD VANE TEST
LAB VANE TEST

NATURAL MOISTURE
PLASTIC AND LIQUID LIMIT
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
% STRAIN AT FAILURE
PENETROMETER

GWL	SYMBOL	SOIL DESCRIPTION	ELEV m	DEPTH m
		75 cm TOPSOIL		0
▽		SILTY SAND TO SANDY SILT-light brown, fine to coarse gravel content increasing with depth, with seams of gravel and cobbles, compact,	1.47	1
				2
				3
				4
				5
				6
		TERMINATED		7
		NOTES:		8
		1. Borehole advanced uncased by Longyear Canada Incorporated on March 26, 1980 using continuous flight auger equipment.		9
		2. Water Level Records		10

ELAPSED TIME	DEPTH TO W.L. (m)	HOLE OPEN TO (m)
on completion	4.72	6.10
March 30/80	1.47	----

N VALUE (ASTM D1586-CSA A119.1)
20 40 60 80
SHEAR STRENGTH MPa

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT
10 20 30

NATURAL UNIT WEIGHT t/m³

G102U

THE TROW GROUP LIMITED

The borehole locations have been established by The UMA Group and are on file with them.

SUBSOIL CONDITIONS

A review of published pedological studies for this area indicates that the subsoils in this area consist primarily of sandy loams and tills associated with moraines and drumlins common to this area. Soils of the Dumfries and Guelph series comprise these glacial features while a deposit of gently rolling sandy loam over outwash gravel (Burford series) borders the creek which courses across the southwest area of concern.

The borings put down at the site confirm this information. Deposits of sandy silt to silty sand with seams of gravel and cobbles were confirmed in all the borings. Due to the extend of area covered by this investigation, it is not possible to correlate the borings. Examination of the recovered samples, however, indicates that, although silty sand to sandy silt was proven in all of the borings, it is not likely to represent a single deposit but rather two or more. For example, Borehole 1, opposite Beachgrove School, is representative of the Dumfries Series soil, while the soil encountered in Borehole 4 is typical of that associated with the Burford series. Each subsoil has different characteristics with regard to permeability (drainage), texture, colour, etc. Details of the subsoil are given on the Borehole Logs, Drawings 1 to 4.

The bedrock was noted to be fairly shallow at this site, with refusal to augers noted at 4.7 m (15.5 feet) and 3.4 m (11.2 feet)in Boreholes 2 and 4, respectively.

The ground water levels were recorded several days after standpipe installation and areshown on the attached borehole logs and percolation test plots.

SEPTIC TILE SUITABILITY

Percolation tests were carried out between March 28 and 30, 1980 following the method specified by the Ontario Ministry of the Environment. In addition, all the test holes were well saturated beyond the minimum recommended by the MOE as it rained at the site over the several days prior to testing. In addition, water was added to each test hole on a practically continuous bases for at least 44 hours before the tests were performed.

The results of the percolation tests are presented on Drawings 6 and 7. Drawing 6 contains the results for Test Holes 1 to 4, inclusive as specified by UMA, whereas Drawing 7 presents the results obtained in six more closely spaced percolation tests performed on the Separate School Property just west of Highway 6 and north of Highway 97.* The percolation rates can be computed from these plots.

With reference to Drawing 6, it is noted that the rate of water fall in Test Hole #1 was very slow. This may possibly be the result of founding the test hole within a localized deposit of silt within the drumlin. Alternatively, and more likely, the slow rate of fall can be attributed to the proximity of the ground water table, i.e., while the adjacent standpipe indicated a water table at approximately 58 inches depth, the ground surface at the standpipe was significantly higher than the test hole location. In addition approximately 16 inches of water was present in the test hole prior to commencement of saturation, and likely reflects a "stabilized" water level. The water level at Test Hole 2 appears to have stabilized near the level of the ground water table recorded in the adjacent standpipe.

Drawing 7 illustrates the large variation in percolation rates even within relatively closely spaced test hole.

* See Drawing 8. A typical Borehole Log from this site is also included, Drawing 5.

We trust that this brief report meets with your satisfactory and that you will contact this office should you require further assistance.

Yours very truly,
THE TROW GROUP LIMITED

M. H. MacKay, P.Eng.

D.Schebesch, P. Eng.

MHM/ml
Encl.
Dist: Underwood McLellan Ltd.
c/o UMA Group (2)

BOREHOLE LOG

JOB No. H3291-G BOREHOLE No. 1 DRAWING No. 1

PROJECT Proposed Development
LOCATION Opposite Beachgrove School
Freelton, Ontario

HOLE LOCATION AND DATUM SEE DRAWING NO. 1

AUGER SAMPLE ⊠
SPT (N) VALUE ○○ ▨
DYNAMIC CONE TEST ——
SHELBY TUBE ●● ■
FIELD VANE TEST +S
LAB VANE TEST t

NATURAL MOISTURE ×
PLASTIC AND LIQUID LIMIT |—o
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE 15 ⊕ 5
% STRAIN AT FAILURE 10
PENETROMETER ▲

GWL	SYMBOL	SOIL DESCRIPTION	ELEV m	DEPTH m
		75 cm TOPSOIL		0
▽		SILTY SAND TO SANDY SILT-light brown, fine to coarse gravel content increasing with depth, with seams of gravel and cobbles, compact,	1.47	1
				2
				3
				4
				5
				6
		TERMINATED		7
		NOTES:		8
		1. Borehole advanced uncased by Longyear Canada Incorporated on March 26, 1980 using continuous flight auger equipment.		9
		2. Water Level Records		10

ELAPSED TIME	DEPTH TO W.L. (m)	HOLE OPEN TO (m)
on completion	4.72	6.10
March 30/80	1.47	----

N VALUE (ASTM D1586-CSA A119.1)
20 40 60 80
SHEAR STRENGTH MPa

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT
10 20 30

NATURAL UNIT WEIGHT t/m³

G102U

THE TROW GROUP LIMITED

BOREHOLE LOG

JOB No. H3291-G | BOREHOLE No. 2 | DRAWING No. 2

PROJECT Proposed Development
LOCATION Near Transformer Station
Freelton, Ontario
HOLE LOCATION AND DATUM SEE DRAWING NO. 1

AUGER SAMPLE ⊠
SPT (N) VALUE ○○ ▨
DYNAMIC CONE TEST ———
SHELBY TUBE ● ● ■
FIELD VANE TEST +S
LAB VANE TEST t

NATURAL MOISTURE x
PLASTIC AND LIQUID LIMIT |—o
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE 0 / 15 ⊕ 5
% STRAIN AT FAILURE 10
PENETROMETER ▲

GWL	SYMBOL	SOIL DESCRIPTION	ELEV m	DEPTH
▽		75 cm - Organics and Stainings	0.55	0
		SILTY SAND TO SANDY SILT-reddish brown, numerous fine gravel, becoming more coarse in seams with depth, compact to dense, wet		1 2 3 4
		REFUSAL TO AUGERS		5
		NOTES:		6
		1. Borehole advanced uncased by Longyear Canada Incorporated on March 26, 1980 using continuous flight auger equipment.		7
		2. Water Level Records		8
		ELAPSED TIME / DEPTH TO W.L. (m) / HOLE OPEN TO (m)		9
		on completion: 2.3 / 4.7		10
		March 30/80: 0.55 / ---		
		3. Free water ponding within 15 m of test hole.		

N VALUE (ASTM D1586-CSA A119.1) 20 40 60 80
SHEAR STRENGTH MPa

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT 10 20 30

NATURAL UNIT WEIGHT t/m³

G102U

THE TROW GROUP LIMITED

BOREHOLE LOG

JOB No. H3291-G | BOREHOLE No. 3 | DRAWING No. 3

PROJECT: Proposed Development
LOCATION: Open Corn Field, Freelton, Ontario
HOLE LOCATION AND DATUM SEE DRAWING NO. 1

AUGER SAMPLE
SPT (N) VALUE
DYNAMIC CONE TEST
SHELBY TUBE
FIELD VANE TEST
LAB VANE TEST

NATURAL MOISTURE
PLASTIC AND LIQUID LIMIT
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
% STRAIN AT FAILURE
PENETROMETER

GWL	SYMBOL	SOIL DESCRIPTION	ELEV m	DEPTH m
▽		SILTY SAND TO SANDY SILT-occ. thin clay seams, numerous fine to medium gravel seams, occ. cobbles, trace of limestone fragments, compact to dense, very moist to wet	2.5	0
		150 mm gravel layer at 3.8 m		1
				2
				3
				4
				5
				6
				7
				8
				9
				10
		TERMINATED		

N VALUE (ASTM D1586-CSA A119.1)
20 40 60 80
SHEAR STRENGTH MPa

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT
10 20 30

NATURAL UNIT WEIGHT t/m³

NOTES:

1. Borehole advanced uncased by Longyear Canada Incorporated on March 26, 1980 using continuous flight auger equipment.

2. Water Level Records

ELAPSED TIME	DEPTH TO W.L. (m)	HOLE OPEN TO (m)
on completion	3.8	6.1
March 30/80	2.5	---

THE TROW GROUP LIMITED

BOREHOLE LOG

JOB No. H3291-G | BOREHOLE No. 4 | DRAWING No. 4

PROJECT Proposed Development
LOCATION Near Trucking Firm
Freelton, Ontario

HOLE LOCATION AND DATUM SEE DRAWING NO. 1

AUGER SAMPLE ⊠
SPT (N) VALUE ○○ ▨
DYNAMIC CONE TEST ———
SHELBY TUBE ● ● ■
FIELD VANE TEST + S
LAB VANE TEST t

NATURAL MOISTURE ×
PLASTIC AND LIQUID LIMIT |—o
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE ⊕ (15 / 5)
% STRAIN AT FAILURE 10
PENETROMETER ▲

GWL	SYMBOL	SOIL DESCRIPTION	ELEV m	DEPTH m
		45 cm TOPSOIL		0
▽		SAND-light brown to brown, fine to medium gravel, till like, cemented, occ. thin gravel seams and large cobbles, dense, moist to wet	1.78	1
				2
				3
		REFUSAL TO AUGERS ON ASSUMED BEDROCK SURFACE		4
				5
		NOTES:		6
		1. Borehole advanced uncased by Longyear Canada Incorporated on March 26, 1980 using continuous flight auger equipment.		7
		2. Water Level Records		8
				9
				10

N VALUE (ASTM D1586-CSA A119.1)
20 40 60 80
SHEAR STRENGTH MPa

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT
10 20 30

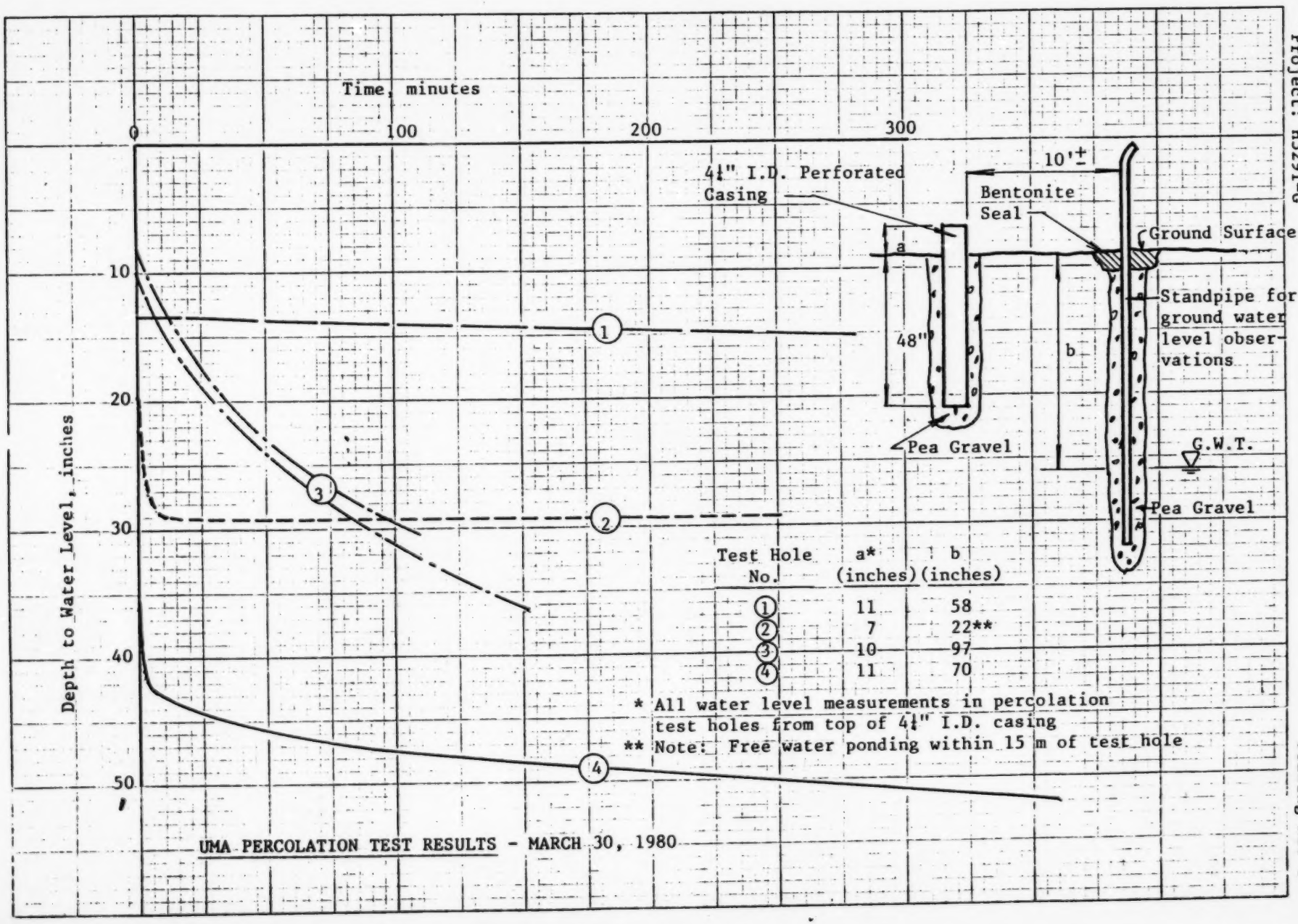
NATURAL UNIT WEIGHT t/m³

ELAPSED TIME	DEPTH TO W.L. (m)	HOLE OPEN TO (m)
on completion	1.78	3.3
March 30/80	1.78	---

G102U

THE TROW GROUP LIMITED

10 X 10 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 0782



Test Hole No.	a* (inches)	b (inches)
1	11	58
2	7	22**
3	10	97
4	11	70

* All water level measurements in percolation test holes from top of 4¼" I.D. casing

** Note: Free water ponding within 15 m of test hole

UMA PERCOLATION TEST RESULTS - MARCH 30, 1980

Project: H3291-G

Drawing No. 6

BOREHOLE LOG

JOB No. H3283-G/H3291-G BOREHOLE No. 4 DRAWING No. 5

PROJECT Proposed School

LOCATION Old Highway #6 and Highway #97 Freelton, Ontario

HOLE LOCATION AND DATUM SEE DRAWING NO. 1

AUGER SAMPLE ⊠ ▨
SPT (N) VALUE ○○
DYNAMIC CONE TEST ——
SHELBY TUBE ● ● ■
FIELD VANE TEST + S
LAB VANE TEST t

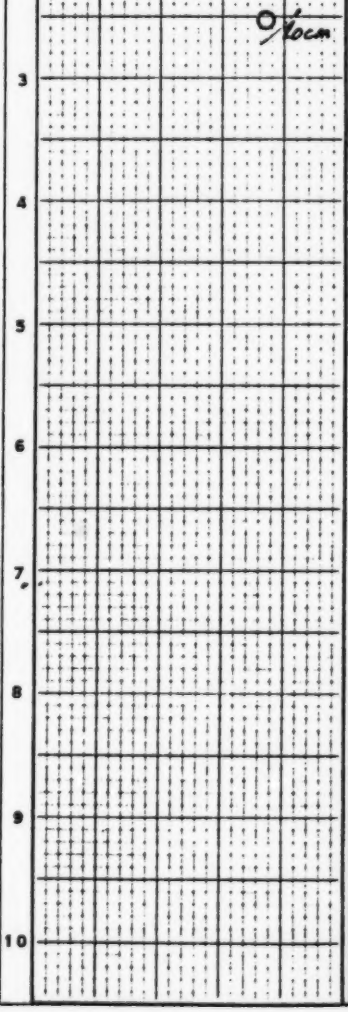
NATURAL MOISTURE x
PLASTIC AND LIQUID LIMIT |—o
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE 15 ⊕ 5
% STRAIN AT FAILURE 10
PENETROMETER ▲

GWL	SYMBOL	SOIL DESCRIPTION	ELEV m	DEPTH m
		45 cm ORGANICS & STAININGS		0
		SANDY SILT-brown, trace of clay, trace of fine to medium gravel, gravel seams noted at 2.5 m depth, compact to very dense, moist		1
				2
				3
		REFUSAL TO AUGERS ON ASSUMED BEDROCK OR BOULDERS		4
		NOTES:		5
		1. Borehole advanced uncased by Longyear Canada Incorporated on February 29, 1980 using continuous flight auger equipment.		6
		2. Water Level Records		7
		ELAPSED TIME: on completion — DEPTH TO W.L. (m): dry — HOLE OPEN TO (m): 2.74		8
		Mar. 30/80 — wet cave — 2.82		9
				10

N VALUE (ASTM D1586-CSA A119.1)
20 40 60 80
SHEAR STRENGTH MPa

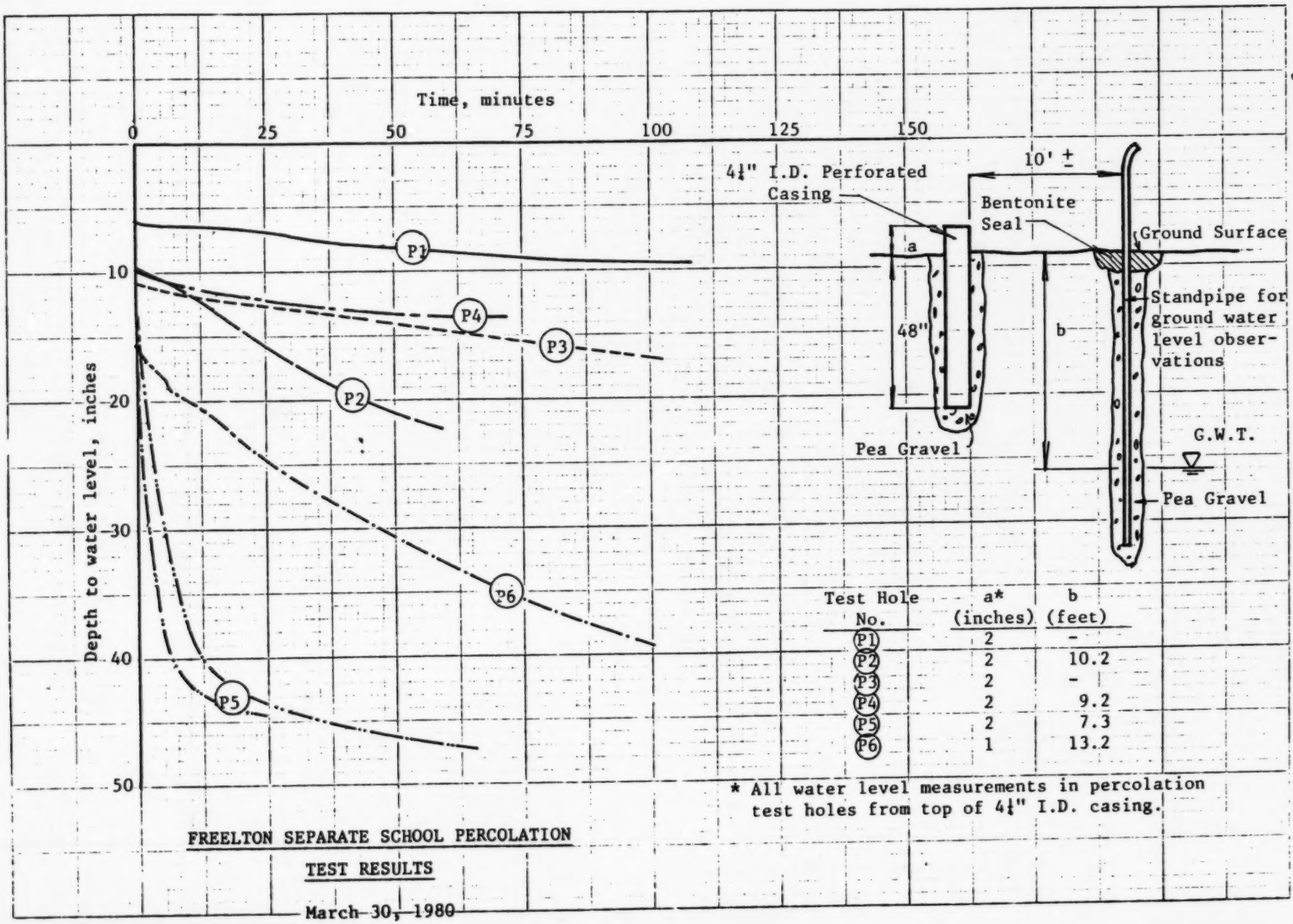
NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT
10 20 30

NATURAL UNIT WEIGHT t/m³



G102U

THE TROW GROUP LIMITED



Test Hole No.	a* (inches)	b (feet)
P1	2	-
P2	2	10.2
P3	2	-
P4	2	9.2
P5	2	7.3
P6	1	13.2

* All water level measurements in percolation test holes from top of 4¼" I.D. casing.

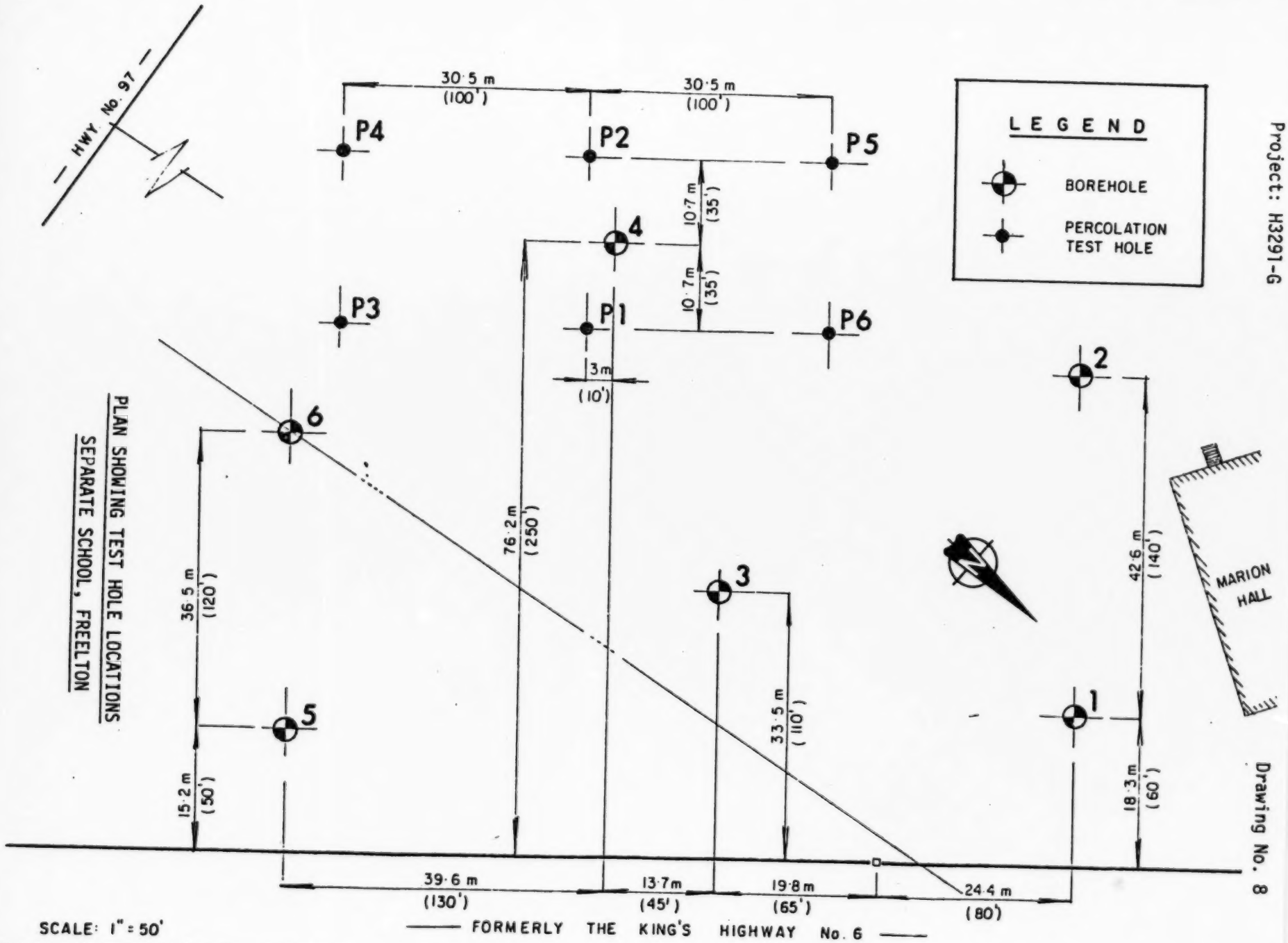
FREELTON SEPARATE SCHOOL PERCOLATION

TEST RESULTS

March 30, 1980

Project: H3291-G

Drawing No. 7


HWY. No. 97
30·5 m (100')
30·5 m (100')
P4
P2
P5
10·7 m (35')
10·7 m (35')
4
P3
P1
P6
3 m (10')
2
6
76·2 m (250')
3
42·6 m (140')
MARION HALL
36·5 m (120')
33·5 m (110')
5
1
15·2 m (50')
18·3 m (60')
39·6 m (130')
13·7 m (45')
19·8 m (65')
24·4 m (80')
LEGEND
BOREHOLE
PERCOLATION TEST HOLE
PLAN SHOWING TEST HOLE LOCATIONS
SEPARATE SCHOOL, FREELTON
SCALE: 1" = 50'
FORMERLY THE KING'S HIGHWAY No. 6
Project: H3291-G
Drawing No. 8

APPENDIX D

SUMMARY DESCRIPTION OF EXISTING WELLS - FREELTON

URBAN DOCUMENTATION CENTRE
RESEARCH UNIT FOR URBAN STUDIES
McMASTER UNIVERSITY
HAMILTON, ONTARIO

APPENDIX D

SUMMARY DESCRIPTION OF EXISTING WELLS - FREELTON

TOWNSHIP OF FLAMBOROUGH

REGION OF HAMILTON-WENTWORTH

WELL NO.	LOCATION CONC	LOT	WATER FOUND FEET	STATIC WATER LEVEL FEET	PUMP LEVEL FEET	TEST RATE GPM	WELL LOG DEPTHS IN FEET TO WHICH FORMATIONS EXTEND		OTHER COMMENTS
1	9	5	62	23	50	8	Brwn clay stns	0014	
							Grey clay	0028	
							Grey lmsn	0064	
2	9	5	27	5	15	15	Brwn sand stns	0022	
							Grey lmsn	0029	
3	9	5	23	9	13	30	Brwn sand grvl	0014	
							Grey lmsn	0025	
4	9	5	14	2	5	20	Brwn grvl fill	0002	
							Blck clay silt stns	0007	
							Grey clay stns	0010	
							Grey lmsn	0015	
5	9	5	20	5	10	20	Grey clay stns	0005	
							Grey clay	0010	
							Grey lmsn	0025	

WELL NO.	LOCATION CONC	LOT	WATER FOUND FEET	STATIC WATER LEVEL FEET	PUMP LEVEL FEET	TEST RATE GPM	WELL LOG DEPTHS IN FEET TO WHICH FORMATIONS EXTEND		OTHER COMMENTS
6	9	5	43	18	40	8	Prdg	0015	
							Grey clay stns	0030	
							Lmsn	0045	
7	9	5	21	5	35	7	Clay msnd grvl	0020	
							Lmsn	0040	
8	9	5	40	18	20	5	Prdg	0012	
							Red clay	0026	
							Lmsn	0056	
9	9	6	56	40	N/A	N/A	Lmsn bldr	0022	
							Lmsn	0050	
							Red shle	0060	
10	9	6	42	20	40	10	Clay bldr	0018	
							Shle	0031	
							Grey lmsn	0070	
11	9	6	65	24	36	12	Prdg stns	0015	
							Brwn lmsn	0065	
12	9	6	60	23	50	10	Grey clay	0018	
							Grey shle rock	0025	
							Grey lmsn	0062	
13	9	6	45	15	25	13	Clay stns	0030	
							Lmsn	0050	
14	9	6	40	30	38	12	Brwn clay	0030	
							Blck shle	0050	

WELL NO.	LOCATION CONC	LOT	WATER FOUND FEET	STATIC WATER LEVEL FEET	PUMP LEVEL FEET	TEST RATE GPM	WELL LOG DEPTHS IN FEET TO WHICH FORMATIONS EXTEND		OTHER COMMENTS
15	9	6	100	35	95	4	Clay stns	0047	
							Blck lmsn	0080	
							Whit lmsn	0102	
16	9	6	49	31	36	25	Brwn grvl sand bldr	0029	
							Grey lmsn	0051	
17	9	6	47	30	34	20	Brwn grvl sand bldr	0026	
							Grey lmsn	0049	
18	9	6	46	28	34	15	Brwn sand grvl stns	0022	
							Grey lmsn	0048	
19	9	6	46	27	36	15	Brwn sand grvl stns	0019	
							Grey lmsn	0047	
20	9	6	48	30	36	20	Brwn sand grvl bldr	0026	
							Grey lmsn	0050	
21	9	6	75	26	60	20	Clay stns	0034	
							Lmsn	0080	
22	9	6	45	22	65	12	Clay stns	0010	
							Shle	0017	
							Lmsn	0071	
23	9	6	55	26	35	10	Clay stns	0040	
							Stns grvl	0045	
							Lmsn	0060	

WELL NO.	LOCATION CONC	LOT	WATER FOUND FEET	STATIC WATER LEVEL FEET	PUMP LEVEL FEET	TEST RATE GPM	WELL LOG DEPTHS IN FEET TO WHICH FORMATIONS EXTEND		OTHER COMMENTS
24	9	6	75	42	56	12	Tpsl	0001	
							Hpan msnd bldr	0012	
							Brwn shle	0017	
							Grey lmsn	0075	
							White lmsn	0083	
25	9	6	36	10	20	13	Clay stns	0032	
							Lmsn shle	0038	
26	9	6	42	15	30	5	Clay stns	0032	
							Lmsn	0045	
27	9	6	48	38	50	7	Bldr grvl msnd	0022	
							Hpan grvl	0050	
28	9	6	28	14	30	3	Bldr grvl	0018	
							Lmsn	0030	
29	9	6	56	15	30	30	Sand Bldr	0026	
							Lmsn	0058	
30	9	6	94	36	80	20	Grey clay stns	0010	
							Grey lmsn	0096	
31	9	6	48	35	39	15	Brwn clay stns	0031	
							Grey clay stns	0025	
							Grey shle	0028	
							Grey lmsn	0051	
32	9	6	93	37	68	15	Grey clay stns	0032	
							Grey Lmsn	0095	

WELL NO.	LOCATION CONC	LOT	WATER FOUND FEET	STATIC WATER LEVEL FEET	PUMP LEVEL FEET	TEST RATE GPM	WELL LOG DEPTHS IN FEET TO WHICH FORMATIONS EXTEND		OTHER COMMENTS
33	9	6	74	46	78	6	Brwn clay bldr	0038	
							Lmsn	0080	
34	9	6	53	15	47	15	Brwn clay msnd	0005	
							Grey clay stns	0027	
							Grey lmsn	0055	
35	9	7	40	25	77	2	Tpsl	0001	
							Brwn clay	0020	
							Lmsn	0080	
36	9	7	50	25	35	17	Clay stns	0023	
							Lmsn	0055	
37	9	7	50	25	45	15	Clay stns	0029	
							Lmsn	0054	
38	9	7	85	30	80	12	Clay stns	0035	
							Lmsn	0090	
39	9	7	52	32	45	7	Prdg	0026	
							Whit lmsn	0056	
40	9	7	51	21	40	20	Brwn clay grvl stns	0020	
							Grey clay grvl	0029	
							Brwn lmsn	0053	
41	9	7	45	18	40	12	Clay stns	0025	
							Lmsn	0050	
42	9	7	70	30	70	8	Clay stns	0022	
							Lmsn	0075	

WELL NO.	LOCATION CONC	LOT	WATER FOUND FEET	STATIC WATER LEVEL FEET	PUMP LEVEL FEET	TEST RATE GPM	WELL LOG DEPTHS IN FEET TO WHICH FORMATIONS EXTEND		OTHER COMMENTS
43	9	7	65	40	70	20	Clay stns	0014	
			88				Whit lmsn	0090	
44	9	7	63	25	50	17	Clay stns	0035	
							Lmsn	0065	
45	9	7	92	40	70	5	Brwn clay	0004	
							Red tpsl csnd	0025	
							Lmsn	0092	
46	9	7	90	35	90	2	Clay stns	0025	
							Shle	0043	
							Whit lmsn	0093	
47	9	7	75	32	70	5	Grey clay stns	0030	
							Lmsn	0078	
48	9	7	43	33	73	4	Brwn tpsl msnd grvl	0014	
							lmsn	0024	
							Grn lmsn	0041	
							Grey lmsn	0061	
							Blue dlmt	0073	
49	8	8	48	20	23	12	Tpsl	0001	
							Clay stns	0005	
							Lmsn	0053	
50	8	8	35	8	22	12	Tpsl	0003	
							Clay stns	0007	
							Lmsn	0040	

WELL NO.	LOCATION CONC	LOT	WATER FOUND FEET	STATIC WATER LEVEL FEET	PUMP LEVEL FEET	TEST RATE GPM	WELL LOG DEPTHS IN FEET TO WHICH FORMATIONS EXTEND		OTHER COMMENTS
51	8	9	50	16	40	10	Clay	0018	
							Lmsn	0052	
52	10	12	29	4	8	30	Brwn clay msnd	0018	
							Grey lmsn	0032	
53	10	13	42	34	77	5	Brwn clay grvl stns	0029	
			88				Grey lmsn	0040	
54	10	13	87	26	55	20	Brwn clay stns	0021	
							Grey lmsn	0088	
55	10	13					Brwn tpsl	0001	
							Brwn bldr grvl clay	0005	
							Brwn lmsn	0019	
							Grey lmsn	0029	
							Brwn lmsn	0068	
							Lmsn shle	0069	
56	10	13	60	20	39	25	Grey clay stns	0018	
							Grey lmsn	0063	
57	10	13	93	45	70	20	Clay stns grvl	0027	
							Lmsn	0095	
58	10	13	45	55	65	20	Clay stns	0035	
			95				Lmsn	0100	
59	10	13	33	17	30	10	Grey clay grvl	0026	
							Lmsn	0035	
60	10	13	38	22	25	5	Grvl bldr	0032	
							Grey lmsn	0038	

WELL NO.	LOCATION CONC	LOT	WATER FOUND FEET	STATIC WATER LEVEL FEET	PUMP LEVEL FEET	TEST RATE GPM	WELL LOG DEPTHS IN FEET TO WHICH FORMATIONS EXTEND		OTHER COMMENTS
61	10	13	39	24	35	10	Clay stns	0034	
							Lmsn	0041	
62	10	13	43	26	45	2	Msnd grvl bldr	0034	
							Lmsn	0045	
63	10	13	80	55	80	20	Grey clay sand grvl	0033	
			100				Grey lmsn	0103	
64	10	13	67	36	37	30	Clay stns	0023	
			94				Lmsn	0097	
65	10	13	40	30	35	30	Prdg	0006	
			70				Clay stns	0015	
							Whit lmsn	0072	
66	10	13	45	35	72	12	Brwn sand clay stns	0007	
			76				Grey stns	0019	
							Brwn sand grvl	0022	
							Grey lmsn	0080	
67	11	12	40	10	25	17	Brwn clay	0010	
							Clay grvl	0025	
							Lmsn	0068	

SOURCE: Water well data systems on record with the Ontario Ministry of the Environment, Stoney Creek, Ontario

APPENDIX E

ALTERNTIVE ON-SITE SYSTEMS

ALTERNATIVE ON-SITE SYSTEMS

In determining whether an area is capable of sustaining future residential development, an important criteria is water consumption. For instance, if water conservation systems such as low water use toilets were employed to reduce water consumption, the required tile field size could be reduced.

Four such toilets have been considered including the "Flush-O-Matic", "Mansfield", "Microphor" and "International Water Saver Toilets Inc.". The Flush-O-Matic only uses about 1 quart of water for each flush. However, this toilet does not have a trap and as such does not meet the Ontario Plumbing Code regulations for installation in a residence. The Mansfield toilet requires 3 quarts per flush. However, we have been advised the unit has not proved to be reliable and plumbing suppliers are hesitant to market the unit. The Microphor toilet requires an auxillary air supply from a small air compressor. Only 3 quarts of water are required for each flush. However, due to the need to install an air compressor in each residence and the lack of a trap that meets the Ontario Plumbing code, we have rejected this unit. The International Water Saver Toilets Inc. toilet operates on a pre-charged air pressure tank and in this way it is possible to use only one gallon per flush. This particular toilet has just been introduced and will shortly be tested in a new development in Waterloo.

A. Reduction in Water Consumption

Changes to the shower heads, use of aerators on the nozzle of all taps, purchase of sud saver type washing machines cannot be legislated or reasonably controlled. Accordingly, it must be concluded that the only satisfactory changes are those which the occupant cannot interfere with. Components such as pressure reducing valves on the service connection and possibly the installation of a pre-charged pressure tank type toilet woud seem to offer the best chance of long term success with an overall water saving of 10 to 15 pgcd. This amount may appear to be small, but can significantly reduce the size and cost of the sewage disposal system.

B. Individual Private Sewage Disposal Systems

A number of individual private systems are available and could be considered in comparison to the standard septic tank and tile field.

(i) Class 6 Systems

A proprietory type plant that includes an effluent sand filter that will effluent discharge to a raised tile field would be considered as a Class 6 system.

These plants require regular attention by a skilled operator as the plant relies on both the maintenance of a biological system for the degradation of organics and a filter for the removal of most of the suspended solids before being discharged to the tile field. The plant process is identical to most municipal plants that is many times larger than the household unit, daily operator attention is required to maintain a suitable environment for the varied cultures of micro-organisms. Because of this operational need, generally the biological portion of the household plant does not function well except to the extent that the sewage is aerated. Accordingly, depending on the useful life of the sand filter the effluent discharged to the tile field will have most of the solids removed.

(ii) Raised Tile Field

A number of variations exist concerning the construction of the tile field to receive the effluent from a standard septic tank or other treatment facility. The field can be constructed to achieve partial disposal of the sewage by percolation into the native soil, storage of the effluent during the late Fall, Winter and early Spring and evapotranspiration during the grass growing season.

(ii) Raised Tile Field (con't)

A raised field can be a suitable alternative in soils having a permeability greater than 10^{-5} cm/sec as the native soils are adequate to achieve percolation of the sewage into the ground. Also, in areas where there is a high water table, a raised tile field can increase the distance between the distribution tiles and the water table. A raised tile field is normally not as effective for effluent disposal as the opportunity for percolation in the horizontal direction is reduced. Accordingly, a greater amount of care is required in the construction of the raised field through deep ploughing of the underlying native soils. Also, it would be necessary to ensure that the sewage has been adequately treated before it reaches the native soils to ensure that a micro-biological growth build-up on the soil particularly does not occur which would inhibit the percolation process.

(iii) Pressurized Tile Fields

Some success has been achieved in clay type low premeable soils where tile field systems have failed through the use of a pressurized tile field system. In one instance in North Carolina, an existing housing development with relatively small lots has almost 100% failure of the standard tile field as evidenced through effluent ponding on the ground surface. The community was served with a communal water supply.

An experimental tile field was constructed. Perforated plastic piping 1 1/2 inches to 2 inches in diameter was installed in trenches with an 18-inch spacing throughout the entire yard. The piping was placed level at about 1.5 feet below ground surface. Native backfill was replaced in the trench with no sand or gravel

(iii) Pressurized Tile Fields (con't)

being used. A small pump well was constructed to receive the effluent from the septic tank and pump it into the tile field. The tile field layout was designed so that a pipe from the far end of the field would return excess sewage flows to the pump well. A pressure reducing valve set at 2 to 3 psi maintained a backpressure on the tile field. The tile runs were in the order of 2,000 linear feet. This system reportedly has worked well and ponding is no longer a problem. On examination of the system, it appears that with the small tile run spacing and the use of native materials as the backfill, that the system has achieved equal distribution of the septic tank effluent over the entire field area.

Also, with the warm water weather that prevails in North Carolina the sewage is being removed by evapotranspiration almost all year round. For this reason, this type of system would not be feasible at our latitude.

(iv) Compost Toilet

Some European countries utilize composting toilets for disposal of the "black" water. The "grey" water is treated separately in a septic tank and tile field. A composting toilet has the advantage that no water is used and the per capita water consumption for other domestic uses is reduced to about 25 gpcd. The composting toilet requires normally that the washroom be located on an outside wall of the house and on the first floor. The toilet and composting tank are an integral unit and the compost is removed for land disposal every few months. There have been many operational difficulties with these toilets and it has been necessary to install heating elements to evaporate off the excess amounts of water. This evaporation process would be expected to produce objectionable odors and is considered to be wasteful of electrical energy.

(v) Incineration

The "Incinolet" toilet has been available in Ontario for a number of years. All wastes are electrically incinerated as an ash. The unit will function provided it is not overloaded as when this happens the heating element is insufficient to achieve rapid burning of the waste.

All water is released as steam. Due to the necessary drying of the waste before incineration can take place these units have created objectionable odors. These units would not be recommended for installation.

(vi) Reuse System

A number of experimental plants have been installed in the U.S. to receive all sewage from a single household into a Class 6 type plant.

In one test, the effluent after filtration was disinfected with iodine and used in a greenhouse. The pea gravel filter produced an effluent BOD and suspended solids of 3 ppm. It was claimed that the water after having been filtered in a charcoal filter could be re-cycled to flush toilets and for lawn watering. However, it is still necessary to discharge a portion of the effluent from the greenhouse irrigation system. This system apparently functioned well. The plant construction cost is about $7,000 U.S. (1979) and to this must be added the greenhouse cost. Because the effluent is well treated and after being used as irrigation water, it would be expected that the BOD would be very low and that the nutrients would be effectively removed.

(vi) Reuse System (con't)

However, we would be concerned about the continued effective operation of such a system installed to serve each premise. Also, it would not be practical to construct a plant and greenhouse for each building or group of buildings. In addition, the greenhouse would have to be heated during the winter as solar heat would not be adequate.

The Thetford Corporation is now marketing a reuse plant under the name "Cycle-Let" and now has a number of installations at service stations and industrial plants. The plant provides biological treatment, settling, ultra filter membrane filtrations and activated carbon absorption with ultra violet or ozone disinfection. The plant, to date, has been used for the recycle of water to toilets. In all instances low water use type toilets have been employed. The cost of this plant is quite high at $40,000 U.S. (1979) to treat approximately 100 gpd. Due to the high cost we would not recommend this plant unless the cost of alternative systems was greater.

(vij) Recycle System

The Pure Cycle Corporation in Boulder Colorado has a recycle plant. The treatment unit includes a rotating biological contactor followed by settling and filtration through ultra filter membranes, activated carbon absorption, cation and anion exchange and disinfection with ultra violet light. The plant is precharged with approximately 1,200 gallons of water and after treatment is stored in a clean water holding tank. The water is used for all domestic needs and reportedly meets all standards respecting water purity requirements.

(vii) Recycle System (con't)

It is necessary that the process be complete recycle, as the treatment plant deionizing system is capable of removing only a fixed amount of chemicals each day. No information is available respecting virus removal. The plant cost is $10,000 U.S. (1979) plus a monthly service charge of $30.00. To this must be added the cost of electricity to operate the plant which would be approximately $12.00 per month.

Assuming the plant does meet all requirements for full recycle social acceptance may be difficult to achieve.

(viii) Holding Tank

A holding tank could be installed for each building or group of buildings with the contents being trucked to one of the Region's sewage treatment plants. Due to the excessive haulage cost that would result if this method of disposal were adopted, this alternative would only be recommended if the majority of buildings could be served with an on-site disposal system and a holding tank was required for a very small number of existing buildings.